UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/613,203	07/03/2003	Gurtej S. Sandhu	303.931US2	4599

21186 7590 06/09/2008

SCHWEGMAN, LUNDBERG & WOESSNER, P.A.
P.O. BOX 2938
MINNEAPOLIS, MN 55402

EXAMINER	
MALDONADO, JULIO J	
ART UNIT	PAPER NUMBER
2823	
MAIL DATE	DELIVERY MODE
06/09/2008	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No.	Applicant(s)	
	10/613,203	SANDHU ET AL.	
	Examiner	Art Unit	
	JULIO J. MALDONADO	2823	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE *3* MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *30 April 2008*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-13,52,53 and 60-70* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-13,52,53 and 60-70* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *07/03/2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☒ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date *04/30/2008*.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

1. The rejection as set forth in the office action mailed on 02/14/2008 is withdrawn in view of the applicants' amendments.

2. Claims 1-13, 52, 53 and 60-70 are pending in the application.

Continued Examination Under 37 CFR 1.114

3. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 04/30/2008 has been entered.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1-4, 8-13, 60, 61, 63 and 67 are rejected under 35 U.S.C. 102(e) as being anticipated by Takehiro et al. (U.S. 6,403,441 B1, hereinafter Takehiro).

In reference to claims 1 and 3, Takehiro (Figs.2d, 4a and 4b) teaches a substrate assembly, comprising a support surface (6); and a plurality of high-K dielectric layers (9, 10, 11) over said support surface, wherein a common metal is present in said layers of said plurality (9, 10, 11), and wherein one of the layers has a higher concentration of oxygen defined by point A (Takehiro Fig.4b) than an underlying layer, defined by point B (Takehiro, Fig.4b), wherein said plurality high-k dielectric layers (9, 10, 11) further includes an oxygen barrier layer (10) that prevents oxides of the support surface (6) (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Takehiro fails to expressly dislcose wherein one layer of the plurality of high-k dielectric layers manifests greater oxidation than would an equivalent thickness of an underlying layer of the plurality.

However, the recitation of “greater oxidation” in claim 1 is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a higher concentration.

In reference to claim 2, Takehiro teaches wherein said plurality of high-K dielectric layers comprise a first high-k dielectric contacting said support surface (Takehiro, column 7, lines 53 – 65).

In reference to claim 4, Takehiro teaches wherein said support surface is a capacitor electrode (Takehiro, column 7, lines 30 – 36).

In reference to claim 8,Takehiro teaches a capacitor dielectric including a plurality of high-k dielectric layers (9, 10, 11), wherein said plurality of high-k dielectric layers further includes a first high-k dielectric layer having a first oxygen concentration defined by point A (Takehiro, Fig.4b) and a second high-k dielectric layer having a second oxygen concentration defined by point B (Takehiro, Fig.4b), which is lower than said first oxygen concentration (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Furthermore, Takehiro discloses wherein the plurality of high-k dielectric layer (9, 10, 11) further comprises an oxygen diffusion barrier layer (10) that prevents oxides in a support surface (6) (Takehiro, column 4, lines 45 – 54).

Takehiro fails to expressly dislcose wherein the first high-k dielectric layer manifests a greater oxidation than would an equivalent thickness of the second high-k dielectric layer.

However, the recitation of “greater oxidation” in claim 8 is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

In reference to claim 9, Takehiro teaches wherein said first high-k capacitor dielectric and said second high-k capacitor dielectric have different thicknesses (Takehiro, column 7, line 53 - column 8, line 27).

In reference to claim 10, Takehiro teaches wherein said first high-k capacitor dielectric and said second high-k capacitor dielectric are oxides (Takehiro, column 7, line 53 - column 8, line 27 and column 15, lines 57 – 67).

In reference to claim 11, Takehiro teaches wherein said first high-k capacitor dielectric is a first oxide with a first oxygen concentration and wherein said second high-k capacitor dielectric is a second oxide different from said first oxide (Takehiro, Fig. 4). Therefore, since the first and the second layer have different oxygen composition, for purposes of this rejection, this is seen as the first layer is different than said second layer.

In reference to claim 12, Takehiro (Figs.2d, 4a and 4b) teaches a capacitor dielectric (9, 10, 11) comprising a first high-k capacitor dielectric comprising a metallic element and contains a first amount of oxygen per unit volume defined by point A (Takehiro, Fig.4a); and a second high-k capacitor dielectric comprising said metallic element and contacting said first high-k capacitor dielectric, wherein said second high-K capacitor dielectric contains a second amount of oxygen per unit volume defined by point B (Takehiro, Fig.4c) different from said first amount, wherein said first high-K capacitor dielectric and said second high-K capacitor dielectric are oxides, and wherein said capacitor dielectric (9, 10, 11) further includes a oxygen diffusion barrier layer (10) resulting in a surface of a lower electrode (6) to be free of oxides (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Takehiro fails to expressly dislcose wherein the first high-k capacitor dielectric manifests a greater oxidation than would an equivalent thickness of the second high-k capacitor dielectric.

However, the recitation of "greater oxidation" is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

In reference to claim 13, Takehiro (Figs.2d, 4a and 4b) teaches a capacitor structure, comprising a first electrode layer (6); a dielectric layer (9, 10, 11) disposed over said first electrode layer (6), wherein said dielectric layer (9, 10, 11) comprises a plurality of consecutively-positioned sub-layers, wherein each of said sub-layers comprises a high-dielectric-constant material, wherein said dielectric layer comprises an element common to all sub-layers of said plurality, wherein the dielectric layer (9, 10, 11) further includes a oxygen diffusion barrier layer (10) that prevents oxides to be formed in said first electrode layer (6) wherein one of said sub-layers has more oxygen, defined by point A (Takehiro, Fig.4b) than another of said sublayers defined by point B (Takehiro, Fig.4b) (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Takehiro fails to expressly dislcose wherein one of the sub-layers of the dielectric layer manifests greater oxidation than would an equivalent thickness of an underlying sub-layer of the dielectric layer further

However, the recitation of "greater oxidation" is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

In reference to claims 60 and 61, Takehiro teaches wherein the at least two layers of said plurality include barium strontium and titanium

In reference to claim 63, Takehiro (Figs.2d, 4a and 4b) teaches a capacitor dielectric (9, 10, 11), comprising a plurality of capacitor dielectric layers, wherein each layer of the plurality is a high-K dielectric, wherein at least one layer of the plurality has a greater concentration of oxygen (Fig.4b, Point A) than an underlying layer (Figs.4b, Point B), and wherein said capacitor dielectric (9, 10, 11) further includes an oxygen barrier layer (10) that prevents oxides from forming in a support surface (6) (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Takehiro fails to expressly dislcose wherein one of the sub-layers of the dielectric layer manifests greater oxidation than would an equivalent thickness of an underlying sub-layer of the dielectric layer further

However, the recitation of "greater oxidation" in claim 63 is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

In reference to claim 67, Takehiro (Figs.2d, 4a and 4b) teaches a capacitor dielectric (9, 10, 11), comprising a plurality of capacitor dielectric layers, wherein each layer of the plurality is a high-K dielectric, wherein at least one layer of the plurality has a greater concentration of oxygen (Fig.4b, Point A) than an underlying layer (Figs.4b, Point B), and wherein said capacitor dielectric (9, 10, 11) further includes an oxygen barrier layer (10) that prevents oxides from forming in a support surface (6) (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27).

Takehiro fails to expressly dislcose wherein at least one layer of the plurality manifests a greater oxidation than would an equal thickness of an underlying layer of the plurality.

However, the recitation of "greater oxidation" in claim 67 is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 5-7, 64-66 and 68-70 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takehiro ('441) as applied to claims 1-4, 8-13, 60, 61, 63 and 67 above, and further in view of the following arguments.

Takehiro teaches wherein the one of the dielectric layers (9) defines a thickness of, for example, 10 nm and another of the dielectric layers (11) defines a thickness of, for example, 40 nm, and wherein the invention is not restricted to these examples (Takehiro, column 16, lines 17 – 35).

Takehiro fails to expressly dislcose wherein said plurality of high-k dielectric layers defines a thickness of at most 200 angstroms; wherein said plurality of high-k dielectric layers comprises a first high-k dielectric layer contacting said support surface and defining a thickness of at least a monolayer; wherein said first high-k dielectric layer defines a thickness of at least 10 angstroms; wherein the plurality of capacitor dielectric layers defines a total thickness that ranges between approximately 50 angstroms and approximately 70 angstroms; wherein each layer of the plurality defines an individual layer thickness that ranges between approximately 10 angstroms and approximately 40 angstroms; and wherein at least a lowest layer of the plurality defines an individual thickness of approximately 20 angstroms.

One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization to obtain a desired plurality of dielectric layer. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess

utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v. TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

8. Claims 52, 53 and 62 are rejected under 35 U.S.C. 103(a) as being unpatentable over Takehiro ('441) in view of the following arguments.

In reference to claims 52 and 53, Takehiro (Figs.2d, 4a and 4b) teaches a capacitor dielectric, comprising a plurality of capacitor dielectric layers (9, 10, 11), wherein each layer of said plurality is a high-K dielectric defining an individual thickness, wherein at least one layer of the plurality has a greater concentration of oxygen (Fig.4b, Point A) than an underlying layer (Figs.4b, Point B), and wherein said capacitor dielectric (9, 10, 11) further includes an oxygen barrier layer (10) that prevents oxides from forming in a support surface (6) (Takehiro, column 4, lines 46 – 54 and column 6, line 16 – column 8, line 27). Furthermore, Takehiro teaches wherein the one of the dielectric layers (9) defines a thickness of, for example, 10 nm and another of the dielectric layers (11) defines a thickness of, for example, 40 nm, and wherein the invention is not restricted to these examples (Takehiro, column 16, lines 17 – 35).

Takehiro fails to expressly dislcose wherein at least one layer of the plurality manifests a greater oxidation than would an equal thickness of an underlying layer of the plurality.

However, the recitation of "greater oxidation" in claim 52 is seen to be a recitation of a dielectric layer of said plurality of layers having a higher concentration of oxygen with respect to another layer of said plurality. Therefore, Takehiro teaches the claimed limitation because Takehiro discloses an overlying dielectric layer having a lower concentration.

Still, Takehiro fails to expressly dislcose wherein said plurality of capacitor dielectric layers defines a total thickness ranging from 50 to 70 angstroms, wherein each layer of said plurality defines an individual thickness ranging from 10 to 40 angstroms in thickness, and wherein at least a lowest layer of said plurality defines an individual thickness of about 20 angstroms.

One of ordinary skill in the art would have been led to the recited dimensions through routine experimentation and optimization to obtain a desired plurality of dielectric layer. Applicant has not disclosed that the dimensions are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical, and it appears prima facie that the process would possess utility using another dimension. Indeed, it has been held that mere dimensional limitations are prima facie obvious absent a disclosure that the limitations are for a particular unobvious purpose, produce an unexpected result, or are otherwise critical. See, for example, In re Rose, 220 F.2d 459, 105 USPQ 237 (CCPA 1955); In re Rinehart, 531 F.2d 1048, 189 USPQ 143 (CCPA 1976); Gardner v.

TEC Systems, Inc., 725 F.2d 1338, 220 USPQ 777 (Fed. Cir. 1984), cert. denied, 469 U.S. 830, 225 USPQ 232 (1984); In re Dailey, 357 F.2d 669, 149 USPQ 47 (CCPA 1966). See also MPEP 2144.04(IV)(B).

Response to Arguments

9. Applicant's arguments with respect to claims 1-13, 52, 53 and 60-70 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Any inquiry concerning this communication or earlier communications from the examiner should be directed to JULIO J. MALDONADO whose telephone number is (571)272-1864. The examiner can normally be reached on Mon-Fri, 8:00 A.M.-4:00 P.M..

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Matthew Smith can be reached on (571)-272-1907. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Julio J. Maldonado
Examiner
Art Unit 2823

/Julio J. Maldonado/
Examiner, Art Unit 2823